

Global Unique Identifier (GUID)
Client User Manual

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1.0	05/17/12	Baseline document that provides an overview of how the GUIDWS system works and how to obtain GUIDs from the system
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Introduction

The Global Unique Identifier, GUID, enables data to be associated with a research participant without exposing or transferring the research participant's personally identifiable information (PII). It is a random number not generated directly from PII. This capability provides two primary benefits. First, it allows data about a research participant to be accumulated across projects over time, regardless of where and when that data were collected. Secondly, it enables a researcher to define a study population while supporting a research hypothesis, even if the data were not collected by the researcher.

This document defines the use of the GUID Client.

GUID Process: How it works

Researchers collect PII (sometimes referred to as Private Health Information or PHI) from their participants and store that data in a local database that is not made available outside the research institution. Typically, that data is only available to a limited number of individuals. It is this data available at the investigator site that is used to generate GUIDs. This is made possible by issuing special software that runs at the research site on an investigator computer or allowing users to access it through an application. This software performs a one-way encryption, often called a one-way hash¹, which is sent to the GUID Client to determine if the research subject hash codes have been seen by the system before. The encrypted hash codes do not have information to recreate the PII. However, they do have enough information to determine if a research participant GUID already exists in the system.

GUID Functions

The following are the service functions that compose the GUID:

Create GUID – This function generates a Valid GUID in a format that is used in the system provided the minimum required PII information is available. This module uses the hash function¹ to generate a unique GUID for each participant. (Refer to the Valid versus Pseudo-GUID section for more information on Valid GUIDs.)

Convert Pseudo GUID to GUID – Allows users to convert Pseudo-GUIDs to Valid GUIDs. Users need to provide the minimum required PII fields and the Pseudo-GUIDs.

¹ A one-way hash is a reproducible method of turning some kind of data into a (relatively) small number that may serve as a digital "fingerprint" of the data. The algorithm "chops and mixes" (i.e., substitutes or transposes) the data to create such fingerprints. The hash represents the "fingerprint". However, it cannot be used to recreate the original.

Create Multiple GUIDs (With and Without Error Checking) — This function generates multiple participant GUIDs from a single call to the server. There are no limits to the number of GUIDs in a request. However, the batch functionality will process 50 participants at a time with a 5 minute delay between each 50 participants processed. The functionality takes as an input a CSV file that includes PII information (Refer to Table 1. PII Fields) and creates as an output with the list of GUID(s).

Generate Pseudo GUID – Generates a Pseudo-GUID with a different format from a Valid GUID. A Pseudo-GUID is a unique ID that is not based on PII. PII is not required to get a Pseudo-GUID. This function should only be used if a user is unable to get a Valid GUID using the Create GUID function due to insufficient PII for a participant. (Refer to the Valid versus Pseudo-GUID section for more information on Pseudo-GUIDs.)

Search if GUID (or Pseudo GUID) exists in the system– Allows users to check if a GUID (or Pseudo GUID) exists in the database. Users must provide a Valid GUID or a Pseudo-GUID to use this function. If the submitted GUID exists in the database, the result will state “The GUID already exists”. If the GUID does not exist in the database, the result will state “The GUID does not exist.”

PII Fields Used to Generate a GUID

The PII fields that are used to generate a GUID are listed below in Table 1. PII Fields. The PII fields are pieces of data that will not change over the lifetime of the participant and are uniquely specific to the participant. Each PII field has an associated probability of a match in the general population. By combining full legal name, date of birth, gender, and municipality of birth, the probability that two individuals share the same information and thus the same hash codes (i.e. a false positive) becomes negligible and is the minimum required information to generate a Valid GUID. Additional data that is provided beyond the required minimum further decreases the probability of a false positive.

PII Field name	Abbreviation used in GUID Client	Required minimum for Valid GUID
Complete legal given name of subject at birth	FIRST_NAME	Yes
Complete legal family name/surname of subject at birth	LAST_NAME	Yes
Complete additional legal name or names at birth	MIDDLE_NAME	Yes
Day of Birth	DOB	Yes
Month of Birth	MOB	Yes
Year of Birth	YOB	Yes
City or Municipality of Birth	CITY_OF_BIRTH	Yes
Physical sex of subject at birth [M/F]	SEX	Yes
Country of Birth	COUNTRY_OF_BIRTH	Yes
Indicator if subject has a Middle Name at Birth	SUBJECT_HAS_MIDDLE_NAME	Yes
Government Issued or National ID (For the United States, this is the Social Security Number)	GIID	No
Country Issuing Government-Issued or National ID	GIIDCOUNTRY	No

Table 1. PII Fields

Special Instructions

1 The "Last Name" field must contain the family name given at birth, prior to legal name change, or marriage. If there is any doubt as to the original legal name at birth, refer to the information on the birth certificate.* Name suffixes such as "Jr.", "Sr.", "III", etc. should be ignored.

2 If the participant's "First Name" is a compound name, such as Anne Marie, or Jose- Luis, it may be unclear whether the second part of the compound is a first name or a middle name. In such cases, use the first name as you would report it on other records, such as school transcripts, or credit card billing statements. If in doubt, refer to the birth certificate.*

3 If the participant does not have a "Middle Name" (known not to have a middle name at birth), enter "NO". If in doubt, refer to the birth certificate.* The GUID Software has a selection to accommodate this possibility.

4 If the "City or Municipality of Birth" has undergone a name change during a participant's lifetime, use the name of the city at the time of the participant's birth. Examples of this are Peking / Beijing, or Bombay / Mumbai. Again, if there is any doubt, refer to the birth certificate.*

* It is recommended that the participant's birth certificate and any copies of the participant's birth certificate be returned to the participant and not retained by the site.

Valid versus Pseudo-GUID

A Valid GUID is a GUID that has been successfully issued using PII and is always a random ID. For retrospective data, it is understood that the minimum amount of PII may not be available or sufficient to generate a Valid GUID. For this reason, the tool provides the capability to issue a Pseudo-GUID. A Pseudo- GUID contains no PII and can be generated using the-Generate Pseudo GUID function. Like a GUID, a Pseudo-GUID will always be unique. Pseudo-GUIDs are not compared to other participants (including Valid GUIDs). The advantage of using a Pseudo-GUID as an ID within a study is that it can later be updated to get a new Valid GUID while maintaining a mapping in the system for the Pseudo-GUID to the Valid GUID.

GUID Composition

A GUID starts with a prefix. The prefix is typically an abbreviation of a disease category. Examples of prefixes are TBI for Traumatic Brain Injury, PD for Parkinson's disease, and GRDR for Global Rare Diseases (Patient) Registry and Data Repository.

Valid GUID Example

An example of a Valid GUID is: TBIAC412JJK

Pseudo GUID Composition

The format of the Pseudo-GUID is identical to that of a Valid GUID with the exception that after the prefix, _INV is added. Prefix_INV...

Pseudo-GUID Example

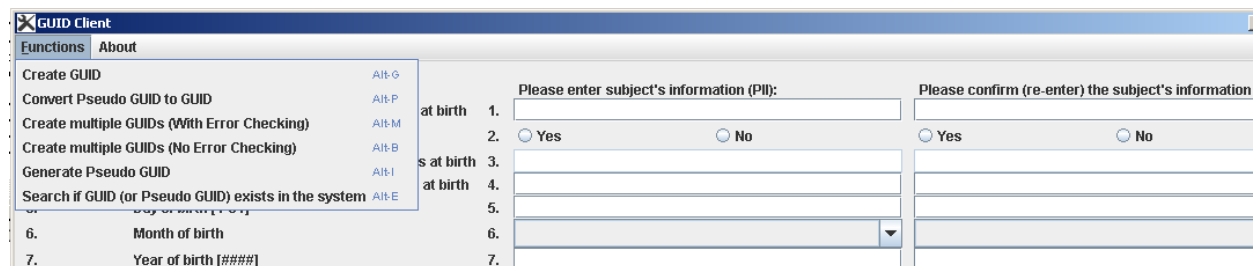
An example of a Pseudo-GUID is: TBI_INVZG542YHV

Using the GUID Tool

The GUID Client software is a Java application allowing it to be run on many different operating systems and in a variety of ways. The GUID Client requires the installation of Java JRE 1.5 or higher to use the Graphical User Interface (GUI) for GUID Tool

Obtaining a GUID

From the Functions menu dropdown, select 'Create GUID'.



The screenshot shows the 'GUID Client' window. The 'Functions' menu is open, displaying options: 'Create GUID' (Alt-G), 'Convert Pseudo GUID to GUID' (Alt-P), 'Create multiple GUIDs (With Error Checking)' (Alt-M), 'Create multiple GUIDs (No Error Checking)' (Alt-B), 'Generate Pseudo GUID' (Alt-I), and 'Search if GUID (or Pseudo GUID) exists in the system' (Alt-E). The main window has two sections: 'Please enter subject's information (PII):' and 'Please confirm (re-enter) the subject's information'. The first section contains fields for '1. at birth', '2. Yes/No', '3. s at birth', '4. at birth', '5.', '6. Month of birth', and '7. Year of birth [####]'. The second section contains corresponding fields for confirmation, including 'Yes/No' radio buttons and text input fields.

Figure 1. Functions Menu

To obtain a GUID for a participant, enter the participant information into the dialog box.

The screenshot shows the 'GUID Client' dialog box. It is organized into three columns. The first column, 'Required Fields', lists 10 items: 1. Complete legal given (first) name of subject at birth, 2. Does the subject have a middle name?, 3. Complete additional (middle) name or names at birth, 4. Complete legal family (last) name of subject at birth, 5. Day of birth [1-31], 6. Month of birth, 7. Year of birth [####], 8. Name of city/municipality in which subject was born, 9. Country of birth, and 10. Physical sex of subject at birth [M/F]. Items 1 through 6 are enclosed in a red rectangular box. The second column, 'Please enter subject's information (PII):', contains input fields for items 1-10, with radio buttons for 'Yes' and 'No' for items 2 and 10. The third column, 'Please confirm (re-enter) the subject's information', contains corresponding input fields for items 1-10. Below these columns are 'Optional Fields' (11. Government Issued or National ID, 12. Country issuing Government-Issued or National ID) and a 'GUID' field. At the bottom are buttons: 'Generate GUID', 'Copy GUID', 'Copy GUID and PII', 'Clear / New', and 'Exit'.

Figure 2. GUID Client Dialog Box

The information should be entered twice — once in each column of the dialog box. The required field names necessary to obtain a valid GUID are listed below:

- Complete legal given (first) name of subject at birth
- Complete legal family (last) name of subject at birth
- Select YES if the subject DOES HAVE a Middle Name, NO otherwise
- Complete additional (middle) name or names at birth
- Day of birth [1—31]
- Month of birth [January-December]
- Year of birth [#####]
- Physical sex of subject at birth [Male/Female]

The following are additional fields that can be used, but are not required:

- Government Issued or National ID number
- Name of the country issuing the Government or National ID

To complete the GUID dialog box and obtain the GUID, complete the following steps, starting in the left column of the dialog box

1. Enter in the complete legal given (first) name of subject at birth.

2. Select Yes or No depending on whether or not the subject has a middle name. If yes, enter information in field 3.
3. Complete the required fields 4—10;
4. If information is available, complete the optional fields 11—12 (Enter the government issued or national ID number into #11 field (note that the list box in #12 field becomes available once data is entered into #11);
5. Select the country of issued ID from the list provided.
6. Enter the same information into the right column of the dialog box (refer to Figure 3. Completing the GUID Client Dialog Box);

The screenshot shows the 'GUID Client' dialog box with two columns of input fields. The left column is labeled 'Required Fields' and the right column is labeled 'Please confirm (re-enter) the subject's information'. The fields are numbered 1 through 12. Fields 1-10 are required, and fields 11-12 are optional. The 'GUID' field is at the bottom left. At the bottom right are buttons for 'Generate GUID', 'Copy GUID', 'Copy GUID and PII', 'Clear / New', and 'Exit'.

Field Number	Field Description	Value Entered	Value Entered (Confirmation)
1.	Complete legal given (first) name of subject at birth	John	John
2.	Does the subject have a middle name?	<input checked="" type="radio"/> No	<input checked="" type="radio"/> No
3.	Complete additional (middle) name or names at birth		
4.	Complete legal family (last) name of subject at birth	Smith	Smith
5.	Day of birth [1-31]	1	1
6.	Month of birth	JANUARY	JANUARY
7.	Year of birth [####]	2001	2001
8.	Name of city/municipality in which subject was born	New York	New York
9.	Country of birth	UNITED STATES	UNITED STATES
10.	Physical sex of subject at birth [M/F]	<input checked="" type="radio"/> Male	<input checked="" type="radio"/> Male
11.	Government Issued or National ID		
12.	Country issuing Government-Issued or National ID		

GUID:

Buttons: Generate GUID, Copy GUID, Copy GUID and PII, Clear / New, Exit

Figure 3a. Completing the GUID Client Dialog Box

*Note that spaces, hyphens and apostrophes can be used in the non-numeric GUID fields in the dialog box and are stripped silently by the application.

7. Click the Generate GUID button

A popup window with the GUID information will appear if there was successful GUID generation. Click the OK button.

The screenshot shows the 'GUID Client' window with the 'Please enter subject's information (PII)' section active. A pop-up window titled 'GUID Generation Successful' displays the 'New GUID: TBIDEMOAT524WRK'. The main dialog box has fields for name, birth date, sex, and location, with a 'Generate GUID' button at the bottom.

Figure 3a. Completing the GUID Client Dialog Box

The GUID then appears in the GUID field at the bottom of the dialog box (refer to Figure 4. Obtaining a GUID). The PII fields and the Generate GUID button will be grayed out only if enough PII is provided and the newly generated GUID is valid.

The screenshot shows the 'GUID Client' window with the 'Please enter subject's information (PII)' section active. The GUID field at the bottom now displays the GUID: TBIDEMOAT524WRK. The 'Generate GUID' button is grayed out, and the 'Copy GUID' and 'Copy GUID and PII' buttons are active.

Figure 4. Obtaining a GUID

To Copy the GUID to the Clipboard

Once the Valid GUID appears in the GUID field (refer to Figure 4. Obtaining a GUID), it can be copied to the Clipboard by clicking the **Copy GUID or Copy GUID and PII button**. This allows the GUID or GUID and PII to be used in other applications. If pasting PII in Excel, the text to column function might be needed to separate data into columns.

	A	B	C	D	E	F	G	H	I	J	K
1	GUID	First Name	Middle Name	Last Name	Subject has middle name?	Month of Birth	Day of Birth	Year of Birth	City of Birth	Country of Birth	Physical Sex at Birth
2	TBIDEMOZU773HV5	JOHN	PATRICK	SMITH	Yes	APRIL	4	1944	BOSTON	US	Male
3											
4											

Figure 4a. Copying GUID and PII into Excel

What happens if the user did not provide enough information?

A GUID will not be issued if the required participant information is not provided. In this case, an Error window will appear listing the missing fields. The missing fields will also be highlighted in red in the dialog box (refer to Figure 5. GUID Error Message Window). To obtain the GUID, the user should provide information for all required fields, and then click the Generate GUID button again.

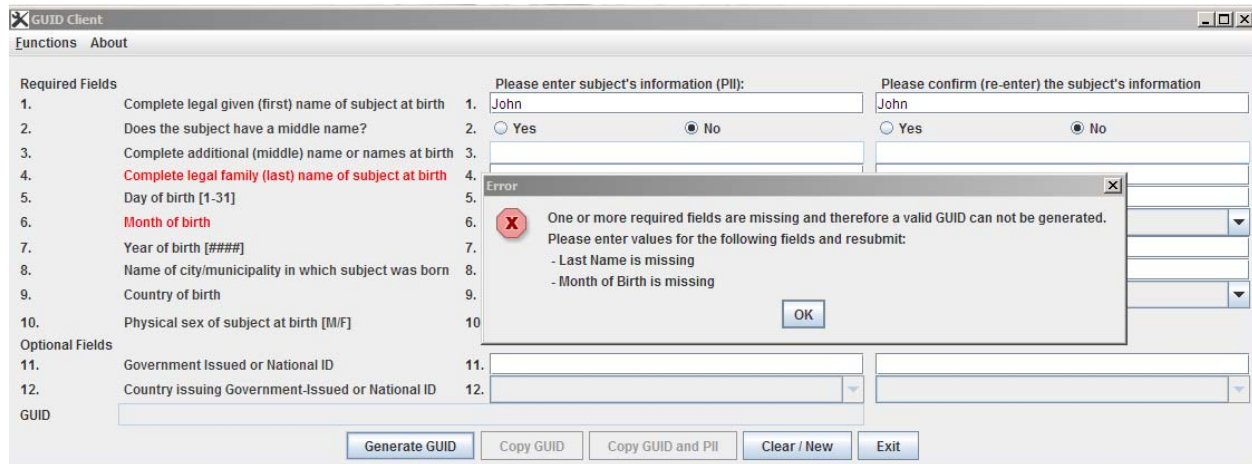


Figure 5. GUID Error Message Window

What happens if the information provided is a close match to other information in the GUID system?

GUID Close Match

The system has implemented an approximate matching algorithm that uses the subject's PII. Before either a GUID is created or returned, the GUID tool first searches for close matches to existing GUIDS. This reduces the chances for multiple GUIDs being created for one subject due to typographical errors.

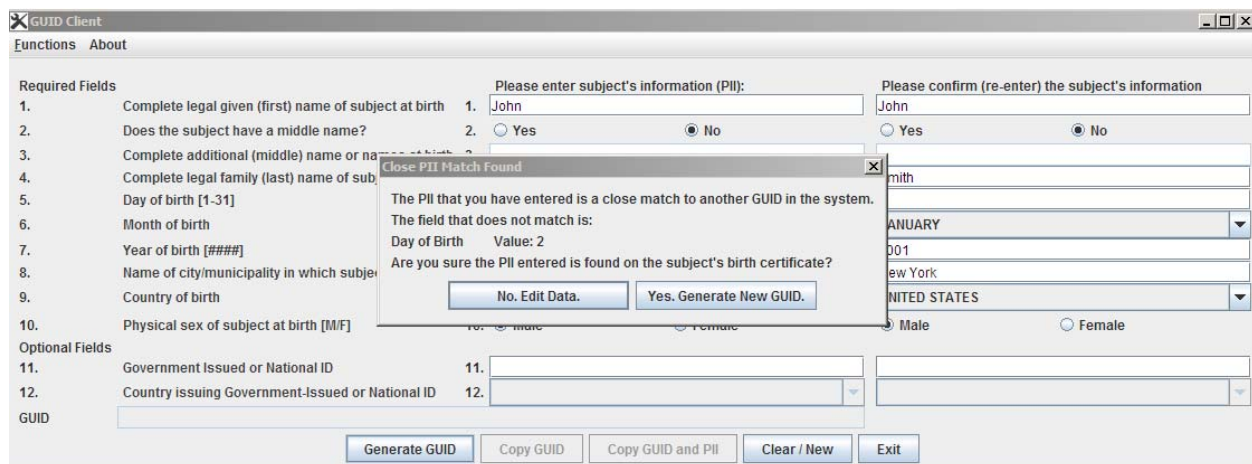


Figure 6. PII Close Match GUID Alert

If you believe there is no error and all values are correct, select the Yes. Generate NEW GUID button.

If you realize that an error has been made, select the No. Edit Data button. You are then redirected to the double data entry, where the PII field that mismatched is highlighted red on the GUID Tool.

The screenshot shows the 'GUID Client' window with a menu bar (Functions, About) and a list of required and optional fields. The 'Required Fields' section includes: 1. Complete legal given (first) name of subject at birth, 2. Does the subject have a middle name?, 3. Complete additional (middle) name or names at birth, 4. Complete legal family (last) name of subject at birth, 5. Day of birth [1-31] (highlighted in red), 6. Month of birth, 7. Year of birth [####], 8. Name of city/municipality in which subject was born, 9. Country of birth, 10. Physical sex of subject at birth [M/F]. The 'Optional Fields' section includes: 11. Government Issued or National ID, 12. Country issuing Government-Issued or National ID. The 'Please enter subject's information (PII):' section contains input fields for the first name (John), middle name (No), last name (Smith), day of birth (2), month of birth (JANUARY), year of birth (2001), city (New York), country (UNITED STATES), and sex (Male). The 'Please confirm (re-enter) the subject's information' section contains corresponding confirmation fields. The 'Generate GUID' button is highlighted in blue.

Figure 7. GUID PII Close Match Highlight

Enter in the correct information in the field highlighted in red and then select the Generate GUID button.

To Create another GUID:

1. Click the Clear/New button;
2. Complete the dialog box for another participant
3. Click the Generate GUID button

Obtaining GUIDs for Multiple Subjects

This batch capability allows a user to create multiple GUIDs at a time.

1. Download the GUID Batch Template (xls) found in the Create GUIDs section of the website.
2. Enter the participants' information into the template.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	id	FIRST_NAME	MIDDLE_NAME	LAST_NAME	SUBJECT_ID	MOB	DOB	YOB	CITY_OF_BIRTH	COUNTRY	SEX	GIID	GIIDCOUNTRY	
2	1	Thomas	Jacob	Lee	Yes	9	13	1988	dc	US	M	123-45-6789	US	
3	2	Gerald	Dean	White	Yes	10	14	1989	dc	US	M	123-09-8765	US	
4	3	Joe		Schmoe	No	11	12	1976	Bethesda	US	M			
5	4	Linda		Johnson	No	8	1	1980	Wheaton	US	F			
6														

Figure 8. Batch GUID Template With and without optional PII

Notes:

- a. See Table 1 for descriptions of column headers.
 - b. Each row contains (1) participants' information
 - c. The REFERENCE_ID should start at 1 (in cell A2) and increment by 1 for each line of information entered into the template.
 - d. For MOB, use a numeric value (1-12)
 - e. For COUNTRY_OF_BIRTH and GIIDCOUNTRY, please use the country codes listed in Appendix A.
For United States, use US.
 - f. For SEX, use f for female and m for male.
 - g. GIID and GIIDCOUNTRY are optional.
 - h. For GIID, if Country issuing the ID is the United States, please submit data in this format ###-##-####.
3. Save the template in CSV format.
 3. Launch the GUID Tool.
 4. Select Functions > Create multiple GUIDs (**With Error Checking**) (see Figure 1)

Note: It is advised to always use this function first. Only use Functions > Create multiple GUIDs (No Error Checking) in the case when you are certain that the PII that has been entered is indeed correct (review all warnings line by line first). If this option is selected, the information entered will not be checked against preexisting GUIDs.

Contact the Operations team if needed before using this functionality.
 5. Browse for and select the desired CSV file to upload from the dialog box that appears

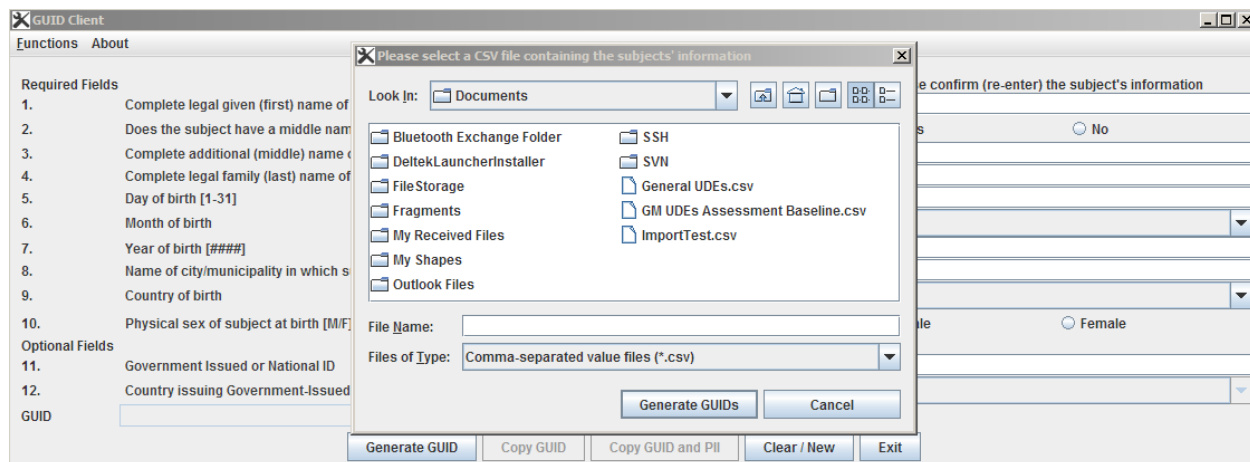


Figure 9. CSV Dialog Box

6. Click the Generate GUIDs button.

The Multiple Subject GUID Request Output dialog box appears displaying the following information:

- Name of the CSV file that has been processed;
- Location of where output of dialog box is saved;
- List of “subject Local ID—GUID” for subjects that obtained GUIDs;
- List of “subject Local ID—Error(s)” for those subjects for whom information was processed with errors, and therefore, did not obtain GUIDs (refer to Figure 10. Multiple Subject GUID Request Output Dialog Box. Errors can also appear in the Error box as well.)

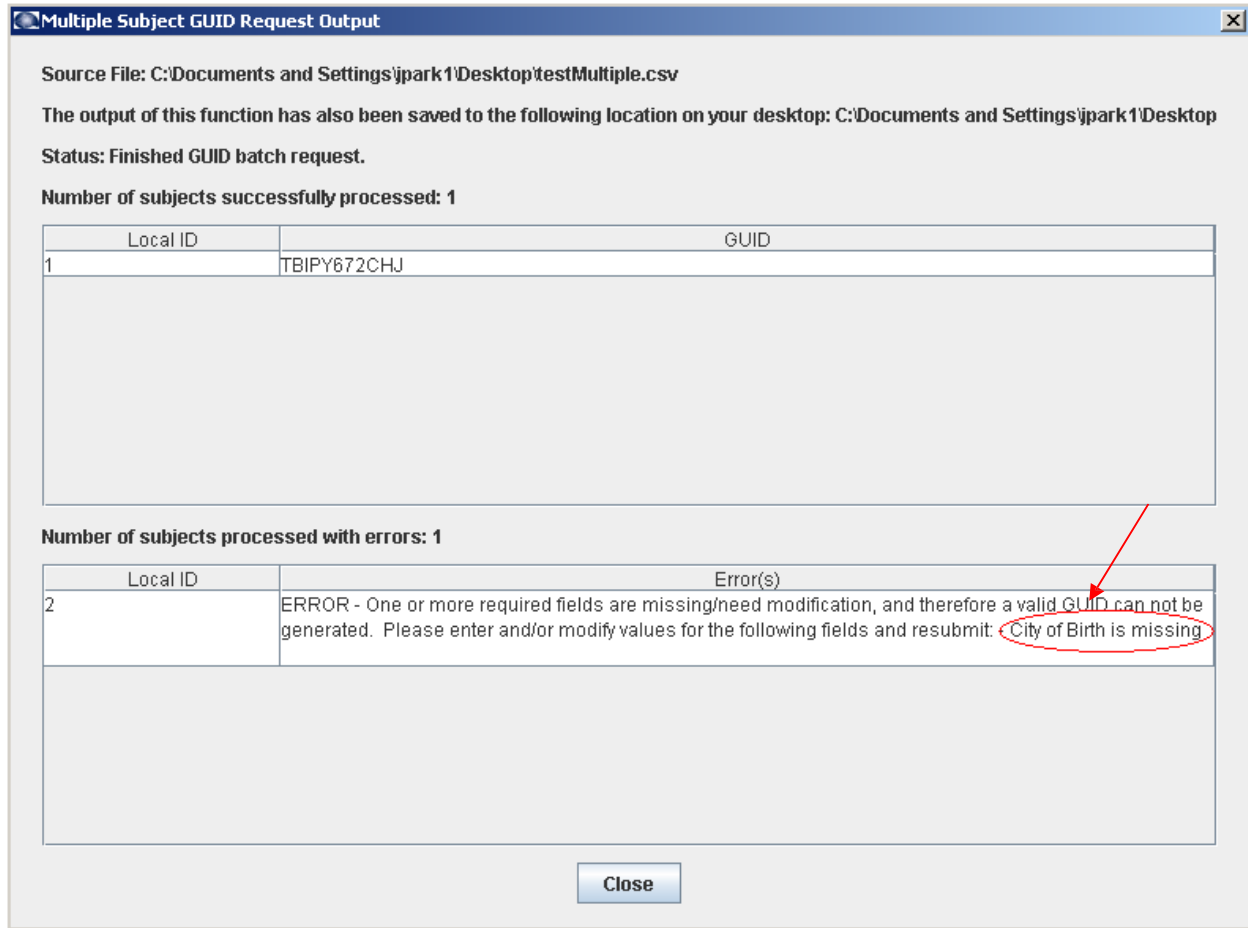


Figure 10. Multiple Subject GUID Request Output Dialog Box (note: the error messages contain missed field names)

Note that if subsequent requests for multiple GUIDs are sent, the required wait time between sending each GUID request containing 50 participants is 30 seconds.

8. Click the Close button to close the dialog box

9. Edit the CSV file and save it.

10. Select the Reload File. Repeat steps until there are no errors and all GUIDs have been successfully generated.

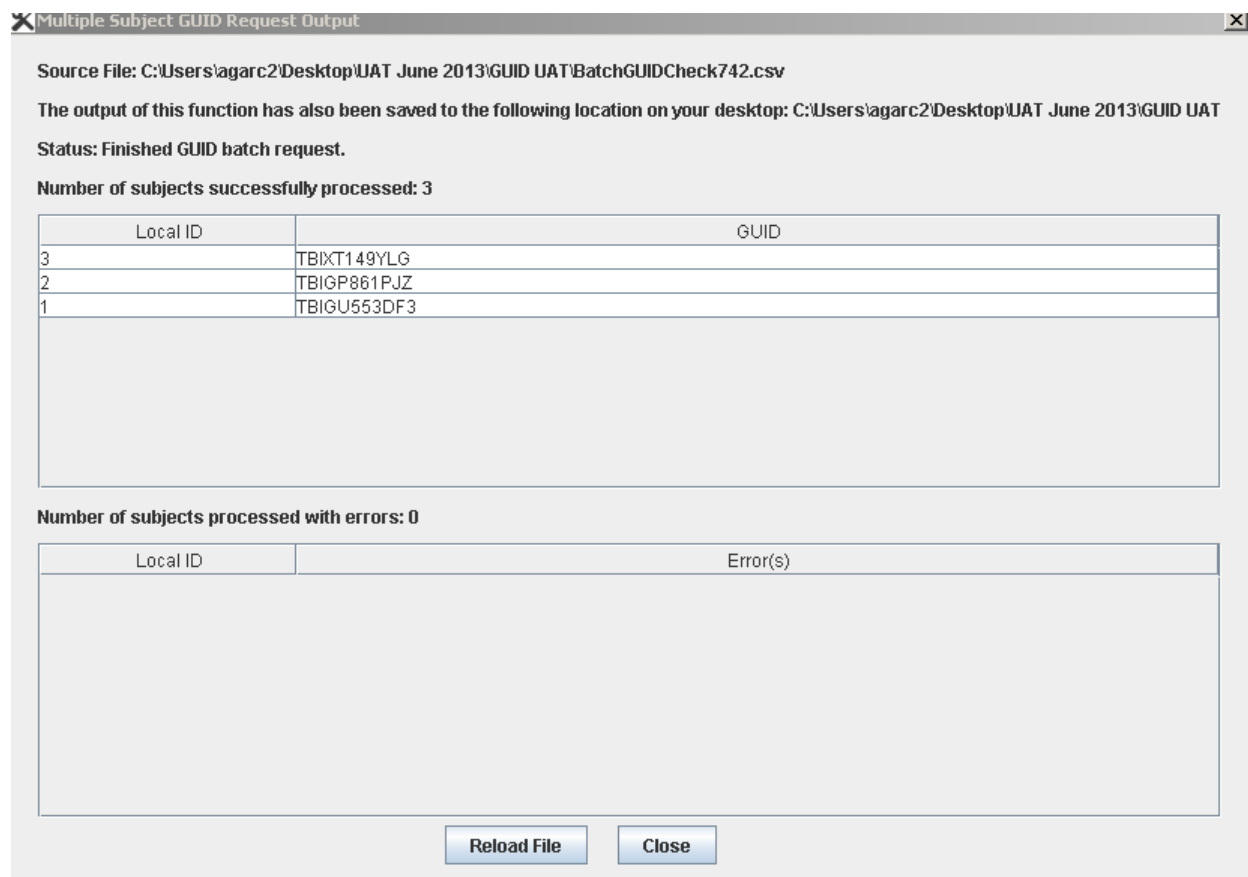


Figure 11. Multiple Subject GUID Request Output Dialog Box (No Errors)

What happens if the information provided in the CVS file is a close match to other information in the GUID system?

GUID Batch Close Match

The GUID Batch Check Code Match is the same functionality used in the GUI (see Obtaining a GUID) If a PII match is found, an alert pop-up box will appear.

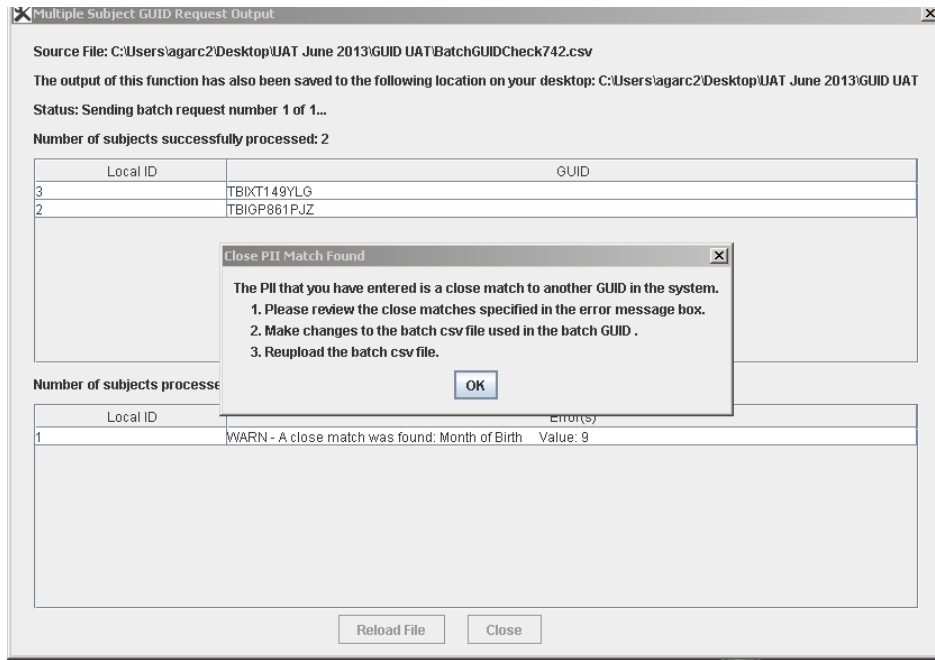


Figure 12. Batch GUID Close PII Match Pop Up

Select OK button. The Check Code matches are displayed in the error/warning box below the valid GUID box.

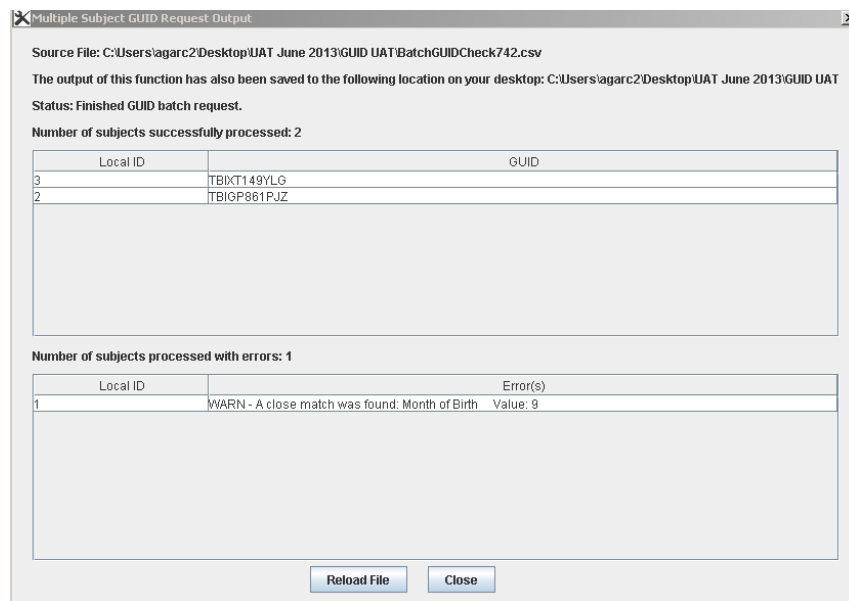


Figure 13. Batch GUID Close PII Error Box

If the warning is valid for the data entered, make changes to the batch file and try again.

If the warning is invalid and the PII entered is correct, select Functions > Create multiple GUIDs (No Error Checking) and create the GUID(s).

Searching if GUID (or Pseudo GUID) Exists

To check if a GUID (or Pseudo GUID) already exists, select Functions > Search if GUID (or Pseudo GUID) exists in the system.

The Check if GUID Exists on the Server dialog box appears (refer to Figure14 Check if GUID Exists on the server Dialog Box). Enter the GUID in the GUID field, and click the Check GUID button. The result appears in the Result field.

Note: This functionality also works when a Pseudo GUID is entered in the GUID field.

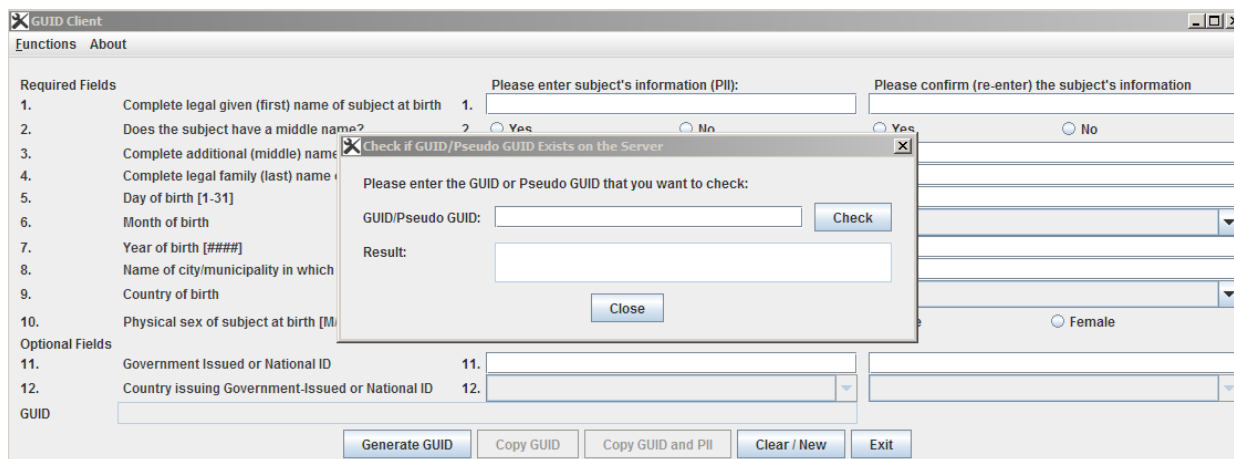


Figure 14. Check if GUID Exists on the server Dialog Box

Obtaining a Pseudo GUID

To obtain a Pseudo-GUID, select Functions > Generate Pseudo GUID.

The Generate Pseudo GUID dialog box appears.

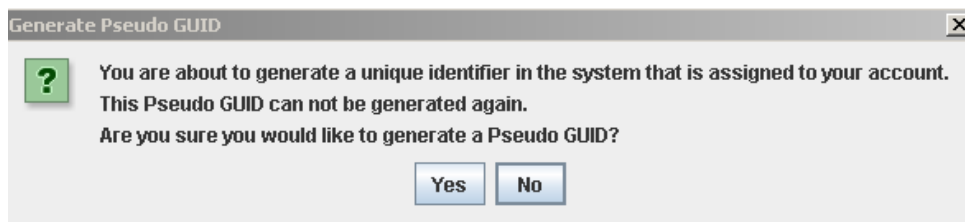


Figure 15. Generate Pseudo GUID dialog box

Click the Yes button.

The software will generate a Pseudo-GUID and display it in the dialog box.

The screenshot shows the 'GUID Client' window with a 'Get Pseudo GUID' dialog box open. The dialog box displays the text 'Pseudo GUID: TBIDEMO_INVXX151ZCV' and an 'OK' button. The background window has three main sections: 'Required Fields', 'Please enter subject's information (PII):', and 'Please confirm (re-enter) the subject's information'. The 'Required Fields' section lists 12 items, including legal name, birth date, and sex. The 'Please enter subject's information (PII):' section contains input fields for these details. The 'Please confirm (re-enter) the subject's information' section contains corresponding fields for confirmation. At the bottom of the main window are buttons for 'Convert Pseudo GUID', 'Copy GUID', 'Copy GUID and PII', 'Clear / New', and 'Exit'.

This screenshot shows the 'GUID Client' window with the 'Generate GUID' button highlighted. The 'Get Pseudo GUID' dialog box is no longer present. The background window shows the same layout as the previous screenshot, but the 'GUID' field at the bottom now contains the text 'TBIDEMO_INVXX151ZCV'. The buttons at the bottom are 'Generate GUID', 'Copy Pseudo GUID', 'Copy Pseudo GUID and PII', 'Clear / New', and 'Exit'.

Figure 16a and 16b. Pseudo GUID dialog box

To copy the Pseudo-GUID to the Clipboard, click the Copy Pseudo GUID button.

Note: Only one GUID can be saved to the clipboard at a time.

Converting Pseudo-GUIDs to Valid GUIDs

To convert a Pseudo-GUID to a Valid GUID, select Functions > Convert Pseudo GUID to GUID from the menu (refer to Figure 17 Selecting the Convert Pseudo GUID to GUID).

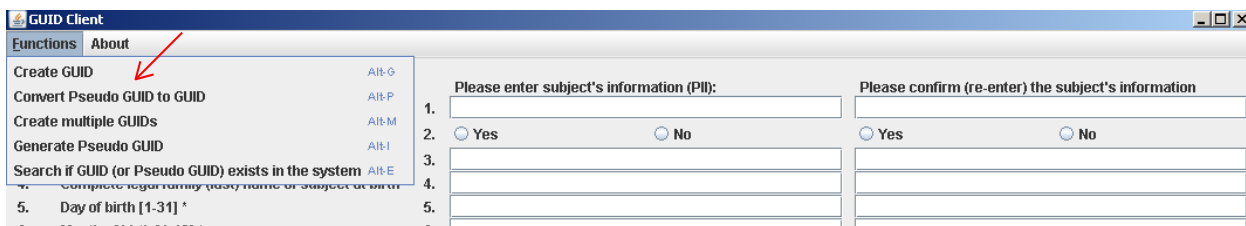


Figure 17. Selecting the Convert Pseudo GUID to GUID

Once the menu item is clicked, the convert Pseudo-GUID dialog box appears (refer to Figure 18. Convert Pseudo GUID to GUID Dialog Box).

Figure 18. Convert Pseudo-GUID to GUID Dialog Box

To convert a Pseudo-GUID to a valid GUID, enter the Pseudo-GUID and the participant information. Then click the Convert Pseudo GUID button. This process is similar to the process of entering participant information to generate a new GUID. If any of the required fields are missing, the error window appears listing the missed fields. (Note: Similar to Figure 4)

To return to the main menu, Select Functions > Create GUID from the menu to return to the main screen (refer to Figure 1).

Troubleshooting

Timestamp Error

The time between the GUID server and a client computer should be synchronized within five minutes difference in order to access the server. Users in the United States should set their local computer clocks to match the time in <http://www.time.gov/> to avoid an error that can be caused by a time difference between the user's computer and the GUID server. In order to ensure that the user's clock remains correct, it is recommended that users utilize a clock synchronization tool, such as Network Time Protocol (NTP), <http://www.ntp.org/>, or some other local synchronization tool.

If the time is not synchronized within five minutes, an error similar to the example below will be generated. Once you get a timestamp error, you will need to close and reopen the GUID tool.

```
login failed
org.apache.axis2.AxisFault: Sorry, your session has timed out. Please restart this webstart client from the GUID website
    at gov.nih.guid.ws.guid.client.AbstractGuidClient.login(AbstractGuidClient.java:563)
    at gov.nih.guid.ws.guid.client.GuidClientFrameWebstart.openConnection(GuidClientFrameWebstart.java:2393)
    at gov.nih.guid.ws.guid.client.GuidClientFrameWebstart.sendSubject(GuidClientFrameWebstart.java:1089)
    at gov.nih.guid.ws.guid.client.GuidClientFrameWebstart.actionPerformed(GuidClientFrameWebstart.java:669)
    at javax.swing.AbstractButton.fireActionPerformed(Unknown Source)
    at javax.swing.AbstractButton$Handler.actionPerformed(Unknown Source)
    at javax.swing.DefaultButtonModel.fireActionPerformed(Unknown Source)
    at javax.swing.DefaultButtonModel.setPressed(Unknown Source)
    at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(Unknown Source)
    at java.awt.Component.processMouseEvent(Unknown Source)
    at javax.swing.JComponent.processMouseEvent(Unknown Source)
    at java.awt.Component.processEvent(Unknown Source)
    at java.awt.Container.processEvent(Unknown Source)
    at java.awt.Component.dispatchEventImpl(Unknown Source)
    at java.awt.Container.dispatchEventImpl(Unknown Source)
    at java.awt.Component.dispatchEvent(Unknown Source)
    at java.awt.LightweightDispatcher.retargetMouseEvent(Unknown Source)
    at java.awt.LightweightDispatcher.processMouseEvent(Unknown Source)
    at java.awt.LightweightDispatcher.dispatchEvent(Unknown Source)
    at java.awt.Container.dispatchEventImpl(Unknown Source)
    at java.awt.Window.dispatchEventImpl(Unknown Source)
    at java.awt.Component.dispatchEvent(Unknown Source)
    at java.awt.EventQueue.dispatchEventImpl(Unknown Source)
    at java.awt.EventQueue.access$000(Unknown Source)
    at java.awt.EventQueue$1.run(Unknown Source)
    at java.awt.EventQueue$1.run(Unknown Source)
    at java.security.AccessController.doPrivileged(Native Method)
    at java.security.AccessControlContext$1.doIntersectionPrivilege(Unknown Source)
    at java.security.AccessControlContext$1.doIntersectionPrivilege(Unknown Source)
    at java.awt.EventQueue$2.run(Unknown Source)
    at java.awt.EventQueue$2.run(Unknown Source)
    at java.security.AccessController.doPrivileged(Native Method)
    at java.security.AccessControlContext$1.doIntersectionPrivilege(Unknown Source)
    at java.awt.EventQueue.dispatchEvent(Unknown Source)
    at java.awt.EventDispatchThread.pumpOneEventForFilters(Unknown Source)
    at java.awt.EventDispatchThread.pumpEventsForFilter(Unknown Source)
    at java.awt.EventDispatchThread.pumpEventsForHierarchy(Unknown Source)
    at java.awt.EventDispatchThread.pumpEvents(Unknown Source)
    at java.awt.EventDispatchThread.run(Unknown Source)
```



Figure 19. Timestamp Error

Appendix A: Country Codes

Country	Country Code
UNITED STATES	US
AFGHANISTAN	AF
ÅLAND ISLANDS	AX
ALBANIA	AL
ALGERIA	DZ
AMERICAN SAMOA	AS
ANDORRA	AD
ANGOLA	AO
ANGUILLA	AI
ANTARCTICA	AQ
ANTIGUA AND BARBUDA	AG
ARGENTINA	AR
ARMENIA	AM
ARUBA	AW
AUSTRALIA	AU
AUSTRIA	AT
AZERBAIJAN	AZ
BAHAMAS	BS
BAHRAIN	BH
BANGLADESH	BD
BARBADOS	BB
BELARUS	BY
BELGIUM	BE
BELIZE	BZ
BENIN	BJ
BERMUDA	BM
BHUTAN	BT
BOLIVIA	BO
BOSNIA AND HERZEGOVINA	BA
BOTSWANA	BW
BOUVET ISLAND	BV
BRAZIL	BR
BRITISH INDIAN OCEAN TERRITORY	IO
BRUNEI DARUSSALAM	BN
BULGARIA	BG
BURKINA FASO	BF

Country	Country Code
BURUNDI	BI
CAMBODIA	KH
CAMEROON	CM
CANADA	CA
CAPE VERDE	CV
CAYMAN ISLANDS	KY
CENTRAL AFRICAN REPUBLIC	CF
CHAD	TD
CHILE	CL
CHINA	CN
CHRISTMAS ISLAND	CX
COCOS (KEELING) ISLANDS	CC
COLOMBIA	CO
COMOROS	KM
CONGO	CG
CONGO, THE DEMOCRATIC REPUBLIC OF THE	CD
COOK ISLANDS	CK
COSTA RICA	CR
CÔTE D'IVOIRE	CI
CROATIA	HR
CUBA	CU
CYPRUS	CY
CZECH REPUBLIC	CZ
DENMARK	DK
DJIBOUTI	DJ
DOMINICA	DM
DOMINICAN REPUBLIC	DO
ECUADOR	EC
EGYPT	EG
EL SALVADOR	SV
EQUATORIAL GUINEA	GQ
ERITREA	ER
ESTONIA	EE
ETHIOPIA	ET
FALKLAND ISLANDS (MALVINAS)	FK
FAROE ISLANDS	FO
FIJI	FJ
FINLAND	FI
FRANCE	FR
FRENCH GUIANA	GF

Country	Country Code
FRENCH POLYNESIA	PF
FRENCH SOUTHERN TERRITORIES	TF
GABON	GA
GAMBIA	GM
GEORGIA	GE
GERMANY	DE
GHANA	GH
GIBRALTAR	GI
GREECE	GR
GREENLAND	GL
GRENADA	GD
GUADELOUPE	GP
GUAM	GU
GUATEMALA	GT
GUERNSEY	GG
GUINEA	GN
GUINEA-BISSAU	GW
GUYANA	GY
HAITI	HT
HEARD ISLAND AND MCDONALD ISLANDS	HM
HOLY SEE (VATICAN CITY STATE)	VA
HONDURAS	HN
HONG KONG	HK
HUNGARY	HU
ICELAND	IS
INDIA	IN
INDONESIA	ID
IRAN, ISLAMIC REPUBLIC OF	IR
IRAQ	IQ
IRELAND	IE
ISLE OF MAN	IM
ISRAEL	IL
ITALY	IT
JAMAICA	JM
JAPAN	JP
JERSEY	JE
JORDAN	JO
KAZAKHSTAN	KZ
KENYA	KE
KIRIBATI	KI

Country	Country Code
KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF	KP
KOREA, REPUBLIC OF	KR
KUWAIT	KW
KYRGYZSTAN	KG
LAO PEOPLE'S DEMOCRATIC REPUBLIC	LA
LATVIA	LV
LEBANON	LB
LESOTHO	LS
LIBERIA	LR
LIBYAN ARAB JAMAHIRIYA	LY
LIECHTENSTEIN	LI
LITHUANIA	LT
LUXEMBOURG	LU
MACAO	MO
MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF	MK
MADAGASCAR	MG
MALAWI	MW
MALAYSIA	MY
MALDIVES	MV
MALI	ML
MALTA	MT
MARSHALL ISLANDS	MH
MARTINIQUE	MQ
MAURITANIA	MR
MAURITIUS	MU
MAYOTTE	YT
MEXICO	MX
MICRONESIA, FEDERATED STATES OF	FM
MOLDOVA, REPUBLIC OF	MD
MONACO	MC
MONGOLIA	MN
MONTENEGRO	ME
MONTSERRAT	MS
MOROCCO	MA
MOZAMBIQUE	MZ
MYANMAR	MM
NAMIBIA	NA
NAURU	NR
NEPAL	NP
NETHERLANDS	NL

Country	Country Code
NETHERLANDS ANTILLES	AN
NEW CALEDONIA	NC
NEW ZEALAND	NZ
NICARAGUA	NI
NIGER	NE
NIGERIA	NG
NIUE	NU
NORFOLK ISLAND	NF
NORTHERN MARIANA ISLANDS	MP
NORWAY	NO
OMAN	OM
PAKISTAN	PK
PALAU	PW
PALESTINIAN TERRITORY, OCCUPIED	PS
PANAMA	PA
PAPUA NEW GUINEA	PG
PARAGUAY	PY
PERU	PE
PHILIPPINES	PH
PITCAIRN	PN
POLAND	PL
PORTUGAL	PT
PUERTO RICO	PR
QATAR	QA
RÉUNION	RE
ROMANIA	RO
RUSSIAN FEDERATION	RU
RWANDA	RW
SAINT BARTHÉLEMY	BL
SAINT HELENA	SH
SAINT KITTS AND NEVIS	KN
SAINT LUCIA	LC
SAINT MARTIN	MF
SAINT PIERRE AND MIQUELON	PM
SAINT VINCENT AND THE GRENADINES	VC
SAMOA	WS
SAN MARINO	SM
SAO TOME AND PRINCIPE	ST
SAUDI ARABIA	SA
SENEGAL	SN

Country	Country Code
SERBIA	RS
SEYCHELLES	SC
SIERRA LEONE	SL
SINGAPORE	SG
SLOVAKIA	SK
SLOVENIA	SI
SOLOMON ISLANDS	SB
SOMALIA	SO
SOUTH AFRICA	ZA
SOUTH GEORGIA AND THE SOUTH SANDWICH ISLANDS	GS
SPAIN	ES
SRI LANKA	LK
SUDAN	SD
SURINAME	SR
SVALBARD AND JAN MAYEN	SJ
SWAZILAND	SZ
SWEDEN	SE
SWITZERLAND	CH
SYRIAN ARAB REPUBLIC	SY
TAIWAN	TW
TAJIKISTAN	TJ
TANZANIA, UNITED REPUBLIC OF	TZ
THAILAND	TH
TIMOR-LESTE	TL
TOGO	TG
TOKELAU	TK
TONGA	TO
TRINIDAD AND TOBAGO	TT
TUNISIA	TN
TURKEY	TR
TURKMENISTAN	TM
TURKS AND CAICOS ISLANDS	TC
TUVALU	TV
UGANDA	UG
UKRAINE	UA
UNITED ARAB EMIRATES	AE
UNITED KINGDOM	GB
UNITED STATES MINOR OUTLYING ISLANDS	UM
URUGUAY	UY
UZBEKISTAN	UZ

Country	Country Code
VANUATU	VU
VATICAN CITY STATE	VA
VENEZUELA	VE
VIET NAM	VN
VIRGIN ISLANDS, BRITISH	VG
VIRGIN ISLANDS, U.S.	VI
WALLIS AND FUTUNA	WF
WESTERN SAHARA	EH
YEMEN	YE
ZAIRE	CD
ZAMBIA	ZM
ZIMBABWE	ZW